Design

From Wikipedia, the free encyclopedia

Design is the creation of a plan or convention for the construction of an object, system or measurable human interaction (as in architectural blueprints, engineering drawings, business processes, circuit diagrams, and sewing patterns).[1] Design has different connotations in different fields (see design disciplines below). In some cases, the direct construction of an object (as in pottery, engineering, management, coding, and graphic design) is also considered to be design.

Designing often necessitates considering the aesthetic, functional, economic, and sociopolitical dimensions of both the design object and design process. It may involve considerable research, thought, modeling, interactive adjustment, and re-design. Meanwhile, diverse kinds of objects may be designed, including clothing, graphical user interfaces, skyscrapers, corporate identities, business processes, and even methods of designing.[2]

Thus "design" may be a substantive referring to a categorical abstraction of a created thing or things (the design of something), or a verb for the process of creation, as is made clear by grammatical context.

Contents

Definitions

More formally design has been defined as follows.

> *(noun) a specification of an object, manifested by an agent, intended to accomplish goals, in a particular environment, using a set of primitive components, satisfying a set of requirements, subject to constraints; (verb, transitive) to create a design, in an environment (where the designer operates)*[3]

Another definition for design is *a roadmap or a strategic approach for someone to achieve a unique expectation. It defines the specifications, plans, parameters, costs, activities, processes and how and what to do within legal, political, social, environmental, safety and economic constraints in achieving that objective.*[4]

Here, a "specification" can be manifested as either a plan or a finished product, and "primitives" are the elements from which the design object is composed.

With such a broad denotation, there is no universal language or unifying institution for designers of all disciplines. This allows for many differing philosophies and approaches toward the subject (see Philosophies and studies of design, below).

The person designing is called a *designer*, which is also a term used for people who work professionally in one of the various design areas, usually also specifying which area is being dealt with (such as a *fashion designer*, *concept designer* or *web designer*). A designer's sequence of activities is called a design process. The scientific study of design is called design science.[5][6][7][8]

Additional definitions, Design is planning to manufacture an object, system, component or structure. Then, the word "design" can be used as a noun or a verb. In a broader sense, the design is an applied art and engineering that integrate with technology.

With a design definition is fairly broad, the design has a myriad of specifications that professionals in their fields, and yet there is one institution that can collect all of the manifesto of the design as a whole, although it does not mean we do not find the schools that initiated the birth of designers.

Design as a process

Substantial disagreement exists concerning how designers in many fields, whether amateur or professional, alone or in teams, produce designs. Dorst and Dijkhuis argued that "there are many ways of describing design processes" and discussed "two basic and fundamentally different ways",[9] both of which have several names. The prevailing view has been called "The Rational Model",[10] "Technical Problem Solving"[11] and "The Reason-Centric Perspective".[12] The alternative view has been called "Reflection-in-Action",[11] "Evolutionary Design",[8] "co-evolution",[13] and "The Action-Centric Perspective".[12]

The Rational Model

The Rational Model was independently developed by Simon[14] and Pahl and Beitz.[15] It posits that:

1. designers attempt to optimize a design candidate for known constraints and objectives,
2. the design process is plan-driven,
3. the design process is understood in terms of a discrete sequence of stages.

The Rational Model is based on a rationalist philosophy[10] and underlies the waterfall model,[16] systems development life cycle,[17] and much of the engineering design literature.[18] According to the rationalist philosophy, design is informed by research and knowledge in a predictable and controlled manner. Technical

rationality is at the center of the process.

Example sequence of stages

Typical stages consistent with The Rational Model include the following.

- Pre-production design
  - Design brief or *Parti pris* – an early (often the beginning) statement of design goals
  - Analysis – analysis of current design goals
  - Research – investigating similar design solutions in the field or related topics
  - Specification – specifying requirements of a design solution for a product (product design specification)[19] or service.
  - Problem solving – conceptualizing and documenting design solutions
  - Presentation – presenting design solutions
- Design during production
  - Development – continuation and improvement of a designed solution
  - Testing – *in situ* testing a designed solution
- Post-production design feedback for future designs
  - Implementation – introducing the designed solution into the environment
  - Evaluation and conclusion – summary of process and results, including constructive criticism and suggestions for future improvements
- Redesign – any or all stages in the design process repeated (with corrections made) at any time before, during, or after production.

Each stage has many associated best practices.[20]

Criticism of the Rational Model

The Rational Model has been widely criticized on two primary grounds

1. Designers do not work this way – extensive empirical evidence has demonstrated that designers do not act as the rational model suggests.[21]
2. Unrealistic assumptions – goals are often unknown when a design project begins, and the requirements and constraints continue to change.[22]

The Action-Centric Model

The Action-Centric Perspective is a label given to a collection of interrelated concepts, which are antithetical to The Rational Model.[12] It posits that:

1. designers use creativity and emotion to generate design candidates,
2. the design process is improvised,
3. no universal sequence of stages is apparent – analysis, design and implementation are contemporary and inextricably linked[12]

The Action-Centric Perspective is based on an empiricist philosophy and broadly consistent with the Agile approach[23] and amethodical development.[24] Substantial empirical evidence supports the veracity of this

perspective in describing the actions of real designers.[21] Like the Rational Model, the Action-Centric model sees design as informed by research and knowledge. However, research and knowledge are brought into the design process through the judgment and common sense of designers – by designers "thinking on their feet" – more than through the predictable and controlled process stipulated by the Rational Model. Designers' context-dependent experience and professional judgment take center stage more than technical rationality.

Descriptions of design activities

At least two views of design activity are consistent with the Action-Centric Perspective. Both involve three basic activities.

In the Reflection-in-Action paradigm, designers alternate between "framing", "making moves", and "evaluate moves." "Framing" refers to conceptualizing the problem, i.e., defining goals and objectives. A "move" is a tentative design decision. The evaluation process may lead to further moves in the design.[11]

In the Sensemaking-Coevolution-Implementation Framework, designers alternate between its three titular activities. Sensemaking includes both framing and evaluating moves. Implementation is the process of constructing the design object. Coevolution is "the process where the design agent simultaneously refines its mental picture of the design object based on its mental picture of the context, and vice versa."[25]

The concept of the Design Cycle is understood as a circular time structure,[26] which may start with the thinking of an idea, then expressing it by the use of visual and/or verbal means of communication (design tools), the sharing and perceiving of the expressed idea, and finally starting a new cycle with the critical rethinking of the perceived idea. Anderson points out that this concept emphasizes the importance of the means of expression, which at the same time are means of perception of any design ideas.[27]

Design disciplines

- Army design methodology[28]
- Applied arts
- Architecture
- Automotive design
- Biological design
- Communication design
- Configuration design
- Design management
- Engineering design
- Experience design
- Fashion design
- Game design
- Graphic design
- Information architecture
- Information design
- Industrial design
- Instructional design
- Interaction design
- Interior design
- Landscape architecture
- Lighting design
- Modular design
- Motion graphic design
- Organization design
- Product design
- Process design
- Service design
- Software design
- Sound design
- Spatial design
- Systems architecture
- Systems design
- Systems modeling
- Urban design
- User experience design
- Visual design
- Web design

Philosophies and studies of design

There are countless philosophies for guiding design as the design values and its accompanying aspects within modern design vary, both between different schools of thought and among practicing designers.[29] Design philosophies are usually for determining design goals. A design goal may range from solving the least significant individual problem of the smallest element, to the most holistic influential utopian goals. Design goals are usually for guiding design. However, conflicts over immediate and minor goals may lead to questioning the purpose of design, perhaps to set better long term or ultimate goals. John Heskett, a 20th-century British writer on design claimed, "Design, stripped to its essence, can be defined as the human nature to shape and make our environment in ways without precedent in nature, to serve our needs and give meaning to our lives."[30]

Philosophies for guiding design

Design philosophies are fundamental guiding principles that dictate how a designer approaches his/her practice. Reflections on material culture and environmental concerns (sustainable design) can guide a design philosophy. One example is the First Things First manifesto which was launched within the graphic design community and states "We propose a reversal of priorities in favor of more useful, lasting and democratic forms of communication – a mindshift away from product marketing and toward the exploration and production of a new kind of meaning. The scope of debate is shrinking; it must expand. Consumerism is running uncontested; it must be challenged by other perspectives expressed, in part, through the visual languages and resources of design."[31]

In *The Sciences of the Artificial* by polymath Herbert A. Simon, the author asserts design to be a meta-discipline of all professions. "Engineers are not the only professional designers. Everyone designs who devises courses of action aimed at changing existing situations into preferred ones. The intellectual activity that produces material artifacts is no different fundamentally from the one that prescribes remedies for a sick patient or the one that devises a new sales plan for a company or a social welfare policy for a state. Design, so construed, is the core of all professional training; it is the principal mark that distinguishes the professions from the sciences. Schools of engineering, as well as schools of architecture, business, education, law, and medicine, are all centrally concerned with the process of design."[32]

Approaches to design

A design approach is a general philosophy that may or may not include a guide for specific methods. Some are to guide the overall goal of the design. Other approaches are to guide the tendencies of the designer. A combination of approaches may be used if they don't conflict.

Some popular approaches include:

- Sociotechnical system design, a philosophy and tools for participative designing of work arrangements and supporting processes - for organizational purpose, quality, safety, economics and customer requirements in core work processes, the quality of peoples experience at work and the needs of society
- KISS principle, (Keep it Simple Stupid), which strives to eliminate unnecessary complications.
- There is more than one way to do it (TIMTOWTDI), a philosophy to allow multiple methods of doing the same thing.
- Use-centered design, which focuses on the goals and tasks associated with the use of the artifact, rather than focusing on the end user.

- User-centered design, which focuses on the needs, wants, and limitations of the end user of the designed artifact.
- Critical design uses designed artifacts as an embodied critique or commentary on existing values, morals, and practices in a culture.
- Service design designing or organizing the experience around a product, the service associated with a product's use.
- Transgenerational design, the practice of making products and environments compatible with those physical and sensory impairments associated with human aging and which limit major activities of daily living.
- Speculative design, the speculative design process doesn't necessarily define a specific problem to solve, but establishes a provocative starting point from which a design process emerges. The result is an evolution of fluctuating iteration and reflection using designed objects to provoke questions and stimulate discussion in academic and research settings.

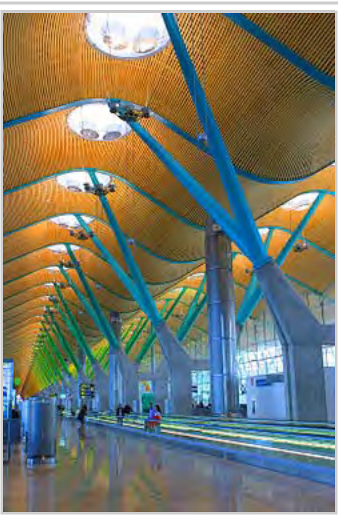
Methods of designing

Design methods is a broad area that focuses on:

- Exploring possibilities and constraints by focusing critical thinking skills to research and define problem spaces for existing products or services—or the creation of new categories; *(see also Brainstorming)*
- Redefining the specifications of design solutions which can lead to better guidelines for traditional design activities (graphic, industrial, architectural, etc.);
- Managing the process of exploring, defining, creating artifacts continually over time
- Prototyping possible scenarios, or solutions that incrementally or significantly improve the inherited situation
- Trendspotting; understanding the trend process.

Terminology

The word "design" is often considered ambiguous, as it is applied differently in a varying contexts.



The new terminal at Barajas airport in Madrid, Spain

Design and art

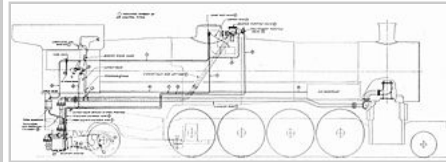
Today, the term design is widely associated with the applied arts as initiated by Raymond Loewy and teachings at the Bauhaus and Ulm School of Design (HfG Ulm) in Germany during the 20th century.

The boundaries between art and design are blurred, largely due to a range of applications both for the term 'art' and the term 'design'. Applied arts has been used as an umbrella term to define fields of industrial design, graphic design, fashion design, etc. The term 'decorative arts' is a traditional term used in historical discourses to describe craft objects, and also sits within the umbrella of applied arts. In graphic arts (2D image making that ranges from photography to illustration), the distinction is often made between fine art and commercial art, based on the context within which the work is produced and how it is traded.

To a degree, some methods for creating work, such as employing intuition, are

shared across the disciplines within the applied arts and fine art. Mark Getlein suggests the principles of design are "almost instinctive", "built-in", "natural", and part of "our sense of 'rightness'."[33] However, the intended application and context of the resulting works will vary greatly.

Design and engineering



A drawing for a booster engine for steam locomotives. Engineering is applied to design, with emphasis on function and the utilization of mathematics and science.

In engineering, design is a component of the engineering process. Many overlapping methods and processes can be seen when comparing Product design, Industrial design and Engineering. The American Heritage Dictionary defines design as: *"To conceive or fashion in the mind; invent,"* and *"To formulate a plan"*, and defines engineering as: *"The application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems."*.[34][35] Both are forms of problem-solving with a defined distinction being the application of "scientific and mathematical principles". The increasingly scientific focus of engineering in practice, however, has raised the importance of new more "human-centered" fields of design.[36] How much science is applied in a design is a question of what is considered "science". Along with the question of what is considered science, there is social science versus natural science. Scientists at Xerox PARC made the distinction of design versus engineering at "moving minds" versus "moving atoms" (probably in contradiction to the origin of term "engineering - engineer" from Latin "in genio" in meaning of a "genius" what assumes existence of a "mind" not of an "atom").



Jonathan Ive has received several awards for his design of Apple Inc. products like this MacBook. In some design fields, personal computers are also used for both design and production

Design and production

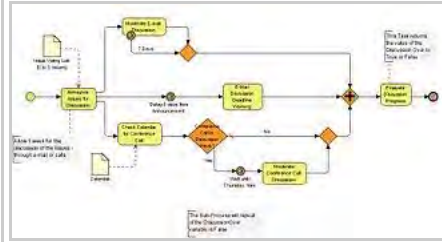
The relationship between design and production is one of planning and executing. In theory, the plan should anticipate and compensate for potential problems in the execution process. Design involves problem-solving and creativity. In contrast, production involves a routine or pre-planned process. A design may also be a mere plan that does not include a production or engineering processes although a working knowledge of such processes is usually expected of designers. In some cases, it may be unnecessary and/or impractical to expect a designer with a broad multidisciplinary knowledge required for such designs to also have a detailed specialized knowledge of how to produce the product.

Design and production are intertwined in many creative professional careers, meaning problem-solving is part of execution and the reverse. As the cost of rearrangement increases, the need for separating design from production increases as well. For example, a high-budget project, such as a skyscraper, requires separating (design) architecture from (production) construction. A Low-budget project, such as a locally printed office party invitation flyer, can be rearranged and printed dozens of times at the low cost of a few sheets of paper, a few drops of ink, and less than one hour's pay of a desktop publisher.

This is not to say that production never involves problem-solving or creativity, nor that design always involves creativity. Designs are rarely perfect and are sometimes repetitive. The imperfection of a design may task a production position (e.g. production artist, construction worker) with utilizing creativity or problem-solving skills to compensate for what was overlooked in the design process. Likewise, a design may be a simple

repetition (copy) of a known preexisting solution, requiring minimal, if any, creativity or problem-solving skills from the designer.

Process design



An example of a business workflow process using Business Process Modeling Notation.

"Process design" (in contrast to "design process" mentioned above) refers to the planning of routine steps of a process aside from the expected result. Processes (in general) are treated as a product of design, not the method of design. The term originated with the industrial designing of chemical processes. With the increasing complexities of the information age, consultants and executives have found the term useful to describe the design of business processes as well as manufacturing processes.

See also

- Design elements and principles
- Design-based learning
- Design thinking

Footnotes

1. Dictionary meanings in the Cambridge Dictionary of American English (http://dictionary.cambridge.org/results.asp?searchword=design&x=64&y=13&=), at Dictionary.com (http://dictionary.reference.com/browse/design) (esp. meanings 1–5 and 7–8) and at AskOxford (http://www.askoxford.com/concise_oed/design?view=uk) (esp. verbs).
2. Brinkkemper, S. (1996). "Method engineering: engineering of information systems development methods and tools". *Information and Software Technology*. **38** (4): 275–280. doi:10.1016/0950-5849(95)01059-9.
3. Ralph, P. and Wand, Y. (2009). A proposal for a formal definition of the design concept. In Lyytinen, K., Loucopoulos, P., Mylopoulos, J., and Robinson, W., editors, Design Requirements Workshop (LNBIP 14), pp. 103–136. Springer-Verlag, p. 109 doi:10.1007/978-3-540-92966-6_6 (https://dx.doi.org/10.1007%2F978-3-540-92966-6_6).
4. Don Kumaragamage, Y. (2011). Design Manual Vol 1
5. Simon (1996)
6. Alexander, C. (1964) Notes on the Synthesis of Form, Harvard University Press.
7. Eekels, J. (2000). "On the Fundamentals of Engineering Design Science: The Geography of Engineering Design Science, Part 1". *Journal of Engineering Design*. **11** (4): 377–397. doi:10.1080/09544820010000962.
8. Braha, D. and Maimon, O. (1998) A Mathematical Theory of Design, Springer.
9. Dorst and Dijkhuis 1995, p. 261
10. Brooks 2010
11. Schön 1983
12. Ralph 2010
13. Dorst and Cross 2001
14. Newell and Simon 1972; Simon 1969
15. Pahl and Beitz 1996
16. Royce 1970
17. Bourque and Dupuis 2004
18. Pahl et al. 2007
19. Cross, N., 2006. T211 Design and Designing: Block 2, p. 99. Milton Keynes: The Open University.

20. Ullman, David G. (2009) The Mechanical Design Process, Mc Graw Hill, 4th edition ISBN 0-07-297574-1
21. Cross et al. 1992; Ralph 2010; Schön 1983
22. Brooks 2010; McCracken and Jackson 1982
23. Beck et al. 2001
24. Truex et al. 2000
25. Ralph 2010, p. 67
26. Thomas Fischer: *Design Enigma. A typographical metaphor for enigmatic processes, including designing*, in: T. Fischer, K. De Biswas, J.J. Ham, R. Naka, W.X. Huang, Beyond Codes and Pixels: Proceedings of the 17th International Conference on Computer-Aided Architectural Design Research in Asia, p. 686
27. Jane Anderson: *Architectural Design*, Basics Architecture 03, Lausanne, AVA academia, 2011, ISBN 978-2-940411-26-9, p. 40
28. Headquarters, Department of the Army (July 2015). *ATP 5-0.1: Army Design Methodology*. Washington D.C.: United States Army.
29. Holm, Ivar (2006). *Ideas and Beliefs in Architecture and Industrial design: How attitudes, orientations and underlying assumptions shape the built environment*. Oslo School of Architecture and Design. ISBN 82-547-0174-1.
30. Heskett, John (2002). *Toothpicks and Logos: Design in Everyday Life*. Oxford University Press.
31. First Things First 2000 a design manifesto (http://maxbruinsma.nl/index1.html?ftf2000.htm). manifesto published jointly by 33 signatories in: Adbusters, the AIGA journal, Blueprint, Emigre, Eye, Form, Items fall 1999/spring 2000
32. Simon (1996), p. 111.
33. Mark Getlein, *Living With Art*, 8th ed. (New York: 2008) 121.
34. American Psychological Association (APA): design (http://dictionary.reference.com/browse/design). The American Heritage Dictionary of the English Language, Fourth Edition. Retrieved January 10, 2007
35. American Psychological Association (APA): engineering (http://dictionary.reference.com/browse/engineering). The American Heritage Dictionary of the English Language, Fourth Edition. Retrieved January 10, 2007
36. Faste 2001

Bibliography

Look up ***design*** in Wiktionary, the free dictionary.

Wikiquote has quotations related to: ***Design***

Wikimedia Commons has media related to ***Design***.

- Beck, K., Beedle, M., van Bennekum, A., Cockburn, A., Cunningham, W., Fowler, M., Grenning, J., Highsmith, J., Hunt, A., Jeffries, R., Kern, J., Marick, B., Martin, R.C., Mellor, S., Schwaber, K., Sutherland, J., and Thomas, D. Manifesto for agile software development (http://www.agilemanifesto.org/), 2001.
- Bourque, P., and Dupuis, R. (eds.) Guide to the software engineering body of knowledge (http://webyes.com.br/wp-content/uploads/ebooks/book_SWEBOK.pdf) (SWEBOK). IEEE Computer Society Press, 2004 ISBN 0-7695-2330-7.
- Brooks, F.P. The design of design: Essays from a computer scientist, Addison-Wesley Professional, 2010 ISBN 0-201-36298-8.
- Cross, N., Dorst, K., and Roozenburg, N. Research in design thinking, Delft University Press, Delft, 1992 ISBN 90-6275-796-0.
- Dorst, K.; Cross, N. (2001). "Creativity in the design process: Co-evolution of problem-solution". *Design Studies*. **22** (2): 425–437. doi:10.1016/0142-694X(94)00012-3.
- Dorst, K., and Dijkhuis, J. "Comparing paradigms for describing design activity," Design Studies (16:2) 1995, pp 261–274.
- Faste, R. (2001). "The Human Challenge in Engineering Design" (PDF). *International Journal of Engineering Education*. **17** (4–5): 327–331.
- McCracken, D.D.; Jackson, M.A. (1982). "Life cycle concept considered harmful". *SIGSOFT Software Engineering Notes*. **7** (2): 29–32. doi:10.1145/1005937.1005943.

- Newell, A., and Simon, H. Human problem solving, Prentice-Hall, Inc., 1972.
- Pahl, G., and Beitz, W. Engineering design: A systematic approach (https://books.google.com/books?id=8fuhesYeJmkC&printsec=frontcover), Springer-Verlag, London, 1996 ISBN 3-540-19917-9.
- Pahl, G., Beitz, W., Feldhusen, J., and Grote, K.-H. Engineering design: A systematic approach (https://books.google.com/books?id=qsKNwB2gL5wC&printsec=frontcover), (3rd ed.), Springer-Verlag, 2007 ISBN 1-84628-318-3.
- Ralph, P. "Comparing two software design process theories," (http://paulralph.name/files/2011/01/Ralph-Comparing-Two-Software-Design-Process-Theories.pdf) International Conference on Design Science Research in Information Systems and Technology (DESRIST 2010), Springer, St. Gallen, Switzerland, 2010, pp. 139–153.
- Royce, W.W. "Managing the development of large software systems: Concepts and techniques," Proceedings of Wescon, 1970.
- Schön, D.A. The reflective practitioner: How professionals think in action, Basic Books, USA, 1983.
- Simon, H.A. The sciences of the artificial (https://books.google.com/books?id=k5Sr0nFw7psC&printsec=frontcover), MIT Press, Cambridge, MA, USA, 1996 ISBN 0-262-69191-4.
- Truex, D.; Baskerville, R.; and Travis, J. (2000). "Amethodical systems development: The deferred meaning of systems development methods". *Accounting, Management and Information Technologies*. **10** (1): 53–79. doi:10.1016/S0959-8022(99)00009-0.

Categories: Design | Architectural design | Arts
